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Updating the Thermal Vacuum Chambers at the NASA Johnson Space Center

Abstract

Chambers A and B are two large thermal vacuum chambers at Johnson Space Center which enable space simulation for unmanned and human-rated missions, respectively. With the resurgence in deep space missions for scientific research and various private commercial ventures, these chambers are expected to be used frequently for at least the next decade. For qualifying the James Webb Space Telescope, upgrades to Chamber A were performed which included the addition of a 12.5 kW refrigeration system with helium shrouds capable of simulating deep space environment and an efficient and reliable LN2 natural flow thermosiphon system for the thermal shield. Continuous improvements since then have focused on ensuring operational readiness by modernizing the data acquisition, recording, controls, and visualization systems for both chambers and clean room. These upgrades will be the focus of this paper.

Controlling the Cryochambers was enhanced by moving from a 32-bit SCADA system to a 64-bit architected system. Infrastructural changes involved installing redundant power circuits, adding new servers, network switches, and including load balancing with fail-over between servers to minimize downtime. Instead of distributed servers, 3 redundant servers are used to share configurations. Configurations are now kept in a shared SQL instance making it easy to deploy and maintain.

During this upgrade process many sub-systems (PLCs and NI PXI interfaces to sensors) were upgraded from the prior OPC-DA to the more secure OPC-UA protocol. Cryo-system PLCs were updated to allow Ganni cycle floating pressure calculations from any cold box to be sent to any compressor. During the project, the team recreated over 70,000 live data points, 50000 historical data points, and 4000 alarms. Finally, the graphical interfaces were upgraded to support HTML 5 in conjunction shared pages were implemented reducing the total number of webpages by over 75%

These system updates reinvigorated the previous SCADA system which had reached its end of life. The same look and feel was maintained while providing operators with an updated interface to control, troubleshoot, and record. The new system architecture is more robust and easier to maintain creating a path forward to address remaining problem points and implement additional features.